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ABSTRACT

Designed to analyze the term educational technology and to demonstrate that multiple conceptions of it exist simultaneously, this paper has four major objectives: (1) to present the importance of conceptual analysis for investigations in the field of educational technology; (2) to demonstrate that the use of metaphor is appropriate for investigating the concept of educational technology; (3) to provide a theoretical framework for the choice of the metaphors--art, craft, science, and engineering--as ways of viewing education technology; and (4) to provide instances of each of the four metaphors from the literature of the field. A discussion of the philosophical basis and conceptual analysis of educational technology highlights historical and reflective interest in concepts and approaches to conceptual study, including historical and sociological approaches and approaches from linguistics and philosophy. Discussion of the study of metaphors focuses on characterizations of the practice of educational technology as an art, a craft, a science, and/or engineering with citations of examples of the metaphors from the literature of the field. It is concluded that these four characterizations of the term educational technology currently exist in the field and have been present for some time. (49 references) (BBM)

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Title:

Educational Technology: A Conceptual Study in Metaphor

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Background

One weakness of the field of educational technology, like many academic fields of study, has been the difficulty that many professionals and practitioners have had explaining the meaning of the terminology of the field. The traditional approach is the commonly heard prescription: define your terms precisely. We often do this when we provide an operational definition in our empirical studies. But it is evident that previous attempts at defining are at least partially responsible for the differing viewpoints with which we are faced, and are partly responsible for the difficulty that we encounter when trying to explain the terminology of the field. Foremost among these difficult terms is educational technology.

There have been many attempts to define the term "educational technology" (AECT, 1977). These have proven to be unsatisfactory in the long term, as witnessed by the frequent efforts of the Association for Educational Communications and Technology's Definition and Terminology Committee. Because of the many changes in both concept and practice that occur within the field, the definition must undergo change. It may be more useful to consider using some different techniques of conceptual analysis when investigating the term educational technology.

Rather than focus on one particular definition, this inquiry is intended to study multiple conceptions of the term "educational technology". Several writers have discussed the idea of multiple conceptions of educational technology (cf. Saettler, 1990 and Roundtree,1979). These studies have treated multiple conceptions of educational technology in a linear/historical fashion,arguing that one conception is replaced by another as time passes. However, this paper argues that multiple conceptions of the term "educational technology" exist simultaneously.

Purpose

The purpose of this paper is to analyze the term "educational technology" and to demonstrate that multiple conceptions of it do, in fact, exist simultaneously. This study has four major objectives: (1) to present the importance of conceptual analysis for investigations in the field of educational technology, (2) to demonstrate that the use of 'metaphor' is appropriate for investigating the concept of educational technology, (3) to provide a theoretical framework for the choice of the metaphors: art, craft, science, and engineering as ways of viewing educational technology, (4) to provide instances of each of the four metaphors, art, science, craft, and engineering from the literature of the field of educational technology.

Philosophical Basis and Conceptual Analysis

Concepts regulate and direct our thought. But concepts are not just matters of the intellect. They govern the way in which we function in our daily lives. "Our concepts structure what we perceive, how we get around in the world, and how we relate to other people" (Lakoff and Johnson, 1980 p.3). This means that the concepts that we use, and the conceptual systems which with we think, are at the heart of how we define our everyday realities.

For purposes of this study it means that the way in which an individual holds a particular concept, in this case the concept of educational technology, will help to determine not only how that individual views the field of educational technology but also how that concept guides the individual's actions within the field of educational technology.

Since the conceptions that one holds of educational technology can help determine how professionals view the field and how professionals function within the field, an analysis of how different individuals view the field will contribute to a greater understanding of the field of educational technology. A better understanding of the concept of educational technology should result in the identification of some of the assumptions and presuppositions that help drive the activities of the field of educational technology.

The questions; "Why do educational technologists think and act the way that they do?" and "What might this thought and activity mean for the field of educational technology?" The first question is primarily a historical question, the second is a matter of reflection. These ideas are intertwined and separating them is difficult. As such, both should be considered in any conceptual study.

Historical interest in concepts

Any conceptual study will be historical in some sense for two reasons; first, we can find certain general historical patterns that often appear when studying the development of concepts. Many concepts pass through two periods: one where there seems to be in strong agreement, followed by one where exceptions begin to appear (Fleck, 1979). An example of this in our field is the changes that have occurred in the definitions of the term "educational technology".

A stylistic bond exists between many concepts of an historical period. This is based on the influence that these concepts have upon each other. There is "a thought style which determines the formulation of a concept" (Fleck, 1979 p.9). Perhaps it is more accurate to say that there are different 'thought styles' that co-exist, and that each thought style has some impact on how a given concept is viewed. Different thought styles emerge more dominant at different points in time. The co-existence of different 'thought styles' might explain how concepts can be thought of differently by different groups of people. Historical investigation shows that strong disagreements often occur about the definition of concepts (Fleck, 1979). Conflicts exist in spite of the fact that, from a logical viewpoint, the various conceptions may be equally plausible.

For our field, it means that educational technologists are not at complete liberty to replace a "mass-media" concept of educational technology with one based solely on the idea of the systems approach. There are 'thought styles' that exist that would oppose this attempt. These 'thought styles' may exist within the field of educational technology, or they may exist outside of the field.

Reflective interest in concepts

In addition to historical interest in concepts, there is also reflective interest. "Concepts in education are often used in ways in which they are normative as well as descriptive "(Gusfield, 1975 p.xvii). In this sense, they can be characterized like theories, which have also been classified as being normative or descriptive. Studying concepts can help us to determine the significance of events and processes as well as just describing them. Studying concepts can also reveal the subtle aspects, that is, the emphasis which may be placed on certain words and actions.

A concept might be considered as a sort of instrument, something that serves us. But it can also be thought of as something that we are inclined to serve, either voluntarily or not. The ideas that matter most to people are the ones that give their experience direction and meaning. But frequently this is done at a subconscious level. Lakoff and Johnson, describe this, saying,

> But our conceptual system is not something that we are normally aware of. In most of the little things we do every day, we simply think and act more or less automatically along certain lines. Just what these lines are is by no means obvious. One way to find out is by looking at language. Since communication is based on the same conceptual system that we use in thinking and acting, language is an important source of evidence for what that system is like (1980, p. 3).

The concept of educational technology is interpreted in many ways. The problem of trying to analyze complex concepts is that there is not one singular meaning which can be arrived at. This difficulty can be thought of as a choice between clarity and utility. It would be simpler if one could define the concept and point to what it conveys. This would represent a consistent, uniform meaning, and imply that consensus exists among educational technologists. But this would be misleading and inaccurate. It would not serve those who wish to study the concept of educational technology to grasp the different usages and contexts of that concept. Nor would it help them to understand the reasons why these differences arose. And it would not aid them in their professional need to cope with the ambiguity which is so prevalent in the field of educational technology.

Approaches to conceptual study

There are a number of different ways in which a phrase or term can been studied. These approaches can be classified in three broad categories, those that are historical in nature, those that are associated with sociology, and those having to do with linguistics and philosophy.

Historical approaches

Etymology focuses on the history of the term. Here the meaning of the term is traced back to its earliest roots. Then subsequent definitions and uses of the term are provided. It is sometimes argued that since a term held a certain meaning in the past, that this past meaning, or portions of it, can be carried forward and reintroduced, and used as it had been in the past.

Studies of the history of ideas also describe the changes in the meanings of particular terms over time. As originally conceived, this approach focused on the "root ideas" which constituted a broader concept (Lovejoy, 1940). Often, these root ideas were the conditions, necessary and sufficient, that set the boundaries of a particular concept. It was reasoned that if the essential components of a concept could be understood, then the meaning of a concept would become clear.

Sociological approaches

Max Weber introduced the "ideal-type" as a way to investigate complex concepts. Weber characterizes this as an imagined construction,

> ...not a description of reality but it aims to give unambiguous means of expression to such a description (Weber,1963 p.28).

Gusfield (1975) uses another sociological approach called the "paired opposites". The idea is to study a concept by relating it to its opposite. His study is a discussion of the concepts of community and society. He provides two poles between which real instances can be ranged as being more or less of one type or another. Gusfield claims that "in using type as paired opposites, the sociologist heightens the understanding of each"(p 13).

Approaches from linguistics and philosophy

In the philosophical/analytic approach, writers expose the problems inherent in the most fashionable definitions of a given concept, they identify and criticize possible alternatives, and then put forth their own viewpoint. There are a number of variations on this theme.

The 'dictionary approach' which is, "the determination of current usage from the users of special vocabularies" (Churchill,1968 p.4). There have been many attempts to explain educational technology by "defining" it (AECT,1977). These attempts were not what might be commonly referred to as definitions, relating the meaning of a term in a sentence or two. Rather they were often lengthy, deductive treatments of the author's conception of educational technology. It is important to note that these studies were deductive. By this it is meant that the author started from a single statement about what educational technology was and then proceeded to elaborate on that statement, about what the parts of the definition were and how they fit together. This was called the "complete" definition statement of educational technology. It was a deductive and systematic explanation of the term educational technology.

These definition statements share some commonalties with what many philosophers and social scientists refer to as conceptual analysis. Both are systematic and detailed treatments of complex terms. However, as Gowin (1982) explains:

> Concept analysis, however, is different from simply giving definitions of the meaning of terms. We would not complete an analysis by looking in dictionaries for the meaning of words. Instead, we are seeking a reason or *explanation for why we use* the terms in particular ways (p.200).

This is the key to the so-called "Oxford School of Philosophy" or the "Philosophy of Ordinary Language". It is from this area of study that we have received the famous dictum 'the meaning is in the use'.

Another very popular method of conceptual analysis concerns itself with determining the necessary and sufficient conditions for a particular instance to be part of a larger classification. In this approach, the attributes of a particular concept that are determined to be necessary in order for its existence are established. Then, certain of these attributes, or combinations of attributes, are deemed to be sufficient for an instance to be considered a member of a larger set or category (Lakoff and Johnson,1980 and others). This is often considered to be the 'traditional approach' to analyzing concepts.

Still another approach to understanding the meaning of a concept is through the study of metaphors. A metaphor, Egon Guba writes,

> ...is a figure of speech in which the meaning of a term or phrase is transferred from the object it ordinarily designates to another object so as to provide new insight or perspective on the latter. In a broader sense, the term metaphor may also designate a process whereby the meanings and relationships of one theory or model may be used to suggest meanings or relationships in another arena (Guba,1978 as cited in Smith, 1982 p.52).

Studying Metaphors

Studying metaphors is recognized as important to the study of literature. Lakoff and Johnson (1980) identify other focal points for metaphorical study;

> Metaphor is for most people a device of the poetic imagination and rhetorical flourish-a matter of extraordinary rather than ordinary language. Moreover, metaphor is typically viewed as characteristic of language alone, a matter of words rather than thought or action (p.3).

There are many different views of metaphor. There are the substitution, semantic and comparison views. There is the interactionist theory of metaphor. There is the pragmatic approach to metaphor. And there is the literal vs root metaphor controversy. These have been classified along a constructivist-nonconstructivist line (Ortony,1979). In the constructivist tradition, Lakoff and Johnson (1980) discuss a variety of "root metaphors" for analyzing conceptual structures. One such example is the "argument is war" metaphor;

> Your claims are indefensible
> He attacked every weak point in my argument
> his criticisms were right on target
> I demolished his argument
> I've never won an argument with him
> You disagree? Okay shoot
> If you use that strategy, he'll wipe you out
> He shot down all of my arguments.
> (Lakoff and Johnson,1980 p.4)

Driscoll (1990) describes the usefulness of using the constructivist approach to metaphor in educational technology, especially within the area of instructional design. Driscoll suggests that using metaphor is a way to identify the assumptions on which instructional design is based.

But one must use caution when employing metaphors. One may select good ones or poor ones and it is often difficult to know the difference without proper criteria (Smith,1981). Further, when used without proper consideration, they can be misleading and inaccurate (Schon,1979).

The use of metaphor to investigate educational technology is not unique to this study (cf. Hlynka & Nelson, 1991 and Driscoll 1990). Hlynka and Nelson (1991) have discussed the metaphors of the term "educational technology". They constructed these "root metaphors" by identifying patterns of language used in the literature of the professional literature.

But there is another aspect to metaphor. It is the figurative side. It is a more traditional approach to the study of metaphor. It involves the overt characterization of educational technology. Sometimes these characterizations are conscious decisions and sometimes they are not. Regardless of the intent of the intent these decisions, these characterizations have a theoretical bases that is historically rich.

If care is taken 'metaphorical study' is a viable form of conceptual study for investigating educational technology. It is one way of getting at the concepts and assumptions that exist within the reality of professional practice. The purpose of "exposing metaphors, and the corresponding myths from which they're derived, frees us to consider alternative ones" (Driscoll, 1990 p.33) and thereby laying the groundwork to change practice.

It is the study of metaphor in terms of "common language" and its relation to thought and action which is central to this study. Here, the investigation of metaphor will focus on characterizations of the practice of educational technology.

On technology

Most people involved in the field of education are familiar with the concepts of "education" and "technology" long before they realize that the two concepts together make up a specific field of study. When combined, these two words take on a new meaning, one which is multifaceted and dynamic.

Considering the many ways in which "educational technology" has been conceptualized, the question arises,"which ones would be most helpful in the study of educational technology?" A historical overview might be helpful.

Many of the studies that are conceptual treatments of "educational technology" include a definition or a discussion of the term technology'. Far fewer of these studies include a definition or discussion of the terms 'education' or 'educational'. One could infer several things from this: (1) that the word education is understood, (2) that technology is the dominant or more important word in the phrase educational technology, (3) that the word 'educational' in the phrase educational technology is a descriptor modifying the purpose of the technology, such as in 'educational television'.

Two of the most frequently cited definitions of technology that are included in conceptual treatments of educational technology are:

> "Technology means the systematic application of scientific or other organized knowledge to practical tasks" (Galbraith,1967 p.24 as cited in AECT, 1977, p.57; Silber,1972, p.36 and Heinich,Molenda,and Russell, 1989, p.24).
>
> "Technology includes processes, systems, management and control mechanisms, both human and non-human, and above all... a way of looking at problems as to their interest, and difficulty, the feasibility of technical solutions, and the economic values-broadly considered-of those solutions." (Finn, in Eboch, 1963, p.17 as cited in AECT, 1977, p.57 and more completely in Ely, 1970, p.85)

A problem with the first definition is the attempt to separate the types of knowledge that are identified. Is "scientific knowledge" not "organized knowledge"? Practically speaking, the definition of technology would read: 'Technology is the systematic application of organized knowledge to practical tasks'. Perkins (1986) argues that, in fact, it is the design or organization of information which makes it knowledge. If this is true than "technology is the application of knowledge to practical tasks." To follow this line of reasoning one would have to ask "what would one apply to practical tasks if not knowledge?" The answer is not clear.

The second definition, while certainly less succinct than the first, is important because it identifies many of the component characteristics of technology. However, this particular definition has a context or interest attached to it. Finn was a proponent of making the field a profession and changing the name of the field to include the word technology. It is not a coincidence that he defined technology to include many of the functions which he believed to be important to professionalizing the audiovisual field (Finn,1953). This suggests that this definition of technology is "loaded" and not appropriate for use in this study.

In a lengthy conceptual study of educational technology W. Kenneth Richmond (1970) examines definitions of words that he argues are the historical basis of the term "technology". He includes the following:

> Technical-Belonging to arts, not in common popular usage.
> (John Walker, *A Critical Pronouncing Dictionary of the English Language, New Edition*, carefully revised, corrected and enlarged, Nelson, 1845.)
>
> Technical-Of or in or peculiar to a particular art or science or craft (t. terms, skill); of or in or the mechanical arts (t.education, school). technicality-being t.,a t.term: technics-doctrine of the arts, technique; technique-manner of artistic execution, the part of artistic work that is reducible to formula, mechanical skill in art.[Gk tekhne art]
> (H.W.Fowler and F. G. Fowler compiled, *The Pocket Oxford Dictionary of Current English, Third Edition*, Oxford at the Clarendon Press, 1939)
>
> Technic-1.= foll.2.= technique (usu.pl) doctrine of arts in general: (pl.) technical terms, details, methods,etc. Hence technician-person skilled in the technique of a particular art, or in arts generally.[Gk tekhnikos (tekhne art,)]
>
> Technical-Of or in a particular art, science, handicraft, etc., as terms, skill, difficulty; of, for in, the mechanical arts, as education, school; legally such, in the eyes of the law, as assault.
>
> Technique-Mode of artistic execution in music, painting, etc: mechanical skill in art.[F,as technic]
>
> Technology-Science of the industrial arts; ethnological study of development of arts.[Gk tekhnologia (tekhne art -logy)]
> (H. W. Fowler and F. G. Fowler (eds.), Concise Oxford Dictionary of Current English, Fourth Edition, Revised by E. McIntosh, Oxford at Clarendon Press, 1951)

Richmond points out that these are related terms and that the list of these related terms has grown tenfold in the period from 1845 to 1951.An undated listing of these terms, from the Oxford English Dictionary (1989) includes:

technic-of or pertaining to art,or craft
A 1.Pertaining to art or an art;
2. Skillfully made or constructed
B. 1.A technical term, expression, point, or detail; a technicality
2. a Technical details or methods collectively; the technical department of a subject; the formal or mechanical part of art.
b. Collective pl. technics in same sense; also construed as a singular.
3. The science or study of art or arts, esp. of mechanical or industrial arts

technical-A.1 Of a person; Skilled in or practically conversant with some particular art or subject.
2. Of a thing ; Skillfully done or made
3. a. Belonging or relating to an art or arts; appropriate or peculiar to, characteristic of, a particular art, science, profession, or occupation; also, of or pertaining to the mechanical arts and applied sciences generally.
b.said of words, terms, phrases, etc., or their senses of acceptations
c.Of an author, a treatise, etc: Using technical terms: treating a subject technically.
d.Technically so called or regarded; that is such as a technical point of view
4. Of, pertaining to, or designating a market in which prices are determined chiefly by internal factors

Technically-In a technical manner; in relation to the arts and applied sciences, or to a practical art or subject; according to technical methods.

Technician-a. A person conversant with the technicalities of a particular subject. b. One skilled in the technique or mechanical part of an art, as music, or painting. c . A person qualified in the practical application of one of the sciences or mechanical arts; now esp. a person whose job is to carry out practical work in a laboratory or to give assistance with technical equipment.

Technicism-1. A technical term or expression, a technicality.
2. Technical quality or character; a condition in which practical results or methods are stressed.

Technicize-To make technical; to subject to a high degree of technicality

Technification-The adoption or imposition of technical methods.

technique-a. Manner of artistic expression execution or performance in relation to formal or practical details (as distinct from general effect, expression, sentiment, etc.); the mechanical or formal part of an art, esp. of any of the fine arts; the manner of execution or performance in any discipline, profession, or sport; also, skill or ability in this department of one's art; mechanical skill in artistic or technical work. loosely a skilful or efficient means of achieving a purpose; a characteristic way of proceeding; a knack.

> Technological-1. Belonging to technical phraseology or methods.
> 2. Relating to or dealing with the study of the arts, esp. the industrial arts.
> 3. Pertaining to or characterized by technology; resulting from developments in technology.
>
> Technology-systematic treatment 1.a. A discourse or treatise on an art or arts; the scientific study of the practical or industrial arts. b. Practical arts collectively. c. A particular practical or industrial art.
>
> (*Oxford English Dictionary,1989*)

The definitions of words related to technology, like the definitions of educational technology, include many words and phrases that are repeated, or rather, held constant. Some of these repeated words and phrases are: "art", "artistic execution", "craft", "systematic study", "scientific study", "science", "mechanical skill", "method", "mechanical arts", "industrial arts", "practical arts", and "applied science".

The last four of these, "mechanical arts", "industrial arts", "practical arts", and "applied science" are all associated with 'engineering'. The remaining words and phrases may all be subsumed by the words "art", "science", and "craft".

There are four views of technology that come close to representing it as art, science, craft, and engineering. These essays were produced by Martin Heiddegger (1977), Jacques Ellul (1963), Victor Ferkis (1969), and William Barrett (1978). Heiddegger (1977) writes for a technology that is art;

> Technology is therefore no mere means. Technology is a way of revealing. If we give heed this, then another whole realm for the essence of technology will open itself up to us. It is the realm of revealing, i.e.,of truth.
>
> This prospect strikes us as strange. Indeed, it should do so, should do so as persistently as possible and with so much urgency that we will finally take seriously the simple question of what "technology" means. The word stems from the Greek. Technikon means that which belongs to techne. We must observe two things with respect to the meaning of the word. One is that techne is the name not only for the activities and skills of a craftsman, but also for the arts of the mind and the fine arts. Techne belongs to bringing-forth, to poiesis; it is something poietic (Heidegger,1977 p.12-13).

Writing for a technology that may be characterized as more craft oriented Ellul (1963) focuses on the word technique. He writes:

> In fact, technique is nothing more than means and the ensemble of means...Techniques considered as methods of operation present certain common characteristics and certain general tendencies...The technical operation includes every operation carried out in accordance with a certain method in order to attain a particular end (Ellul,1963 p.19).

Ferkis (1969) criticizes Ellul's notion of technique and writes for a technology that is more an engineering concept argues:

> In so broadly conceiving technology there is obviously the danger of falling into the trap of Ellul and other writers for whom technology is technique and everything is technique and therefore all human actions are technological. We can avoid this pitfall if we think of technology as a self-conscious organized means of affecting the physical or social environment, capable of being objectified and transmitted to others, and effective largely independently of the subjective dispositions or personal talents of those involved. Thus an opera singer exhibits "technique" but is not really utilizing a technology.(Ferkis,1969 p.37-38).

"Technology is embodied technique" (Barrett, 1978 p.18). A technique is a standard method that can be taught. Continuing his discussion of the inseparability of technology and science Barrett argues that:

> It is method, and the dominance of method that marks the chief difference between modern science and the science of the Greeks. It is an attempt to control and predict phenomena rather than submit to its existence that differentiates between the two. Modern science could be considered as a movement from theory into practice with method at the core of the discussion. The individual (knower) no longer merely observes what is. Rather, the individual sets the conditions, asks the questions and elicits the answers. The meanings of the questions and answers themselves become less separable in the conditions established by the new science. Technology is not the application of the new science it is the heart of the new science (Barrett,1978 p.).

An analysis of these definitions and conceptual discussions reveals that technology is seen in different ways but there is a common theme that runs through them. The theme is that technology is a *process*.

Art, Craft, Science and Engineering in Education

A study of the history of education over the last one hundred years reveals that education, and many of the concepts that are associated with education, are often characterized as art, science, craft, and engineering. Philosopher John Dewey has, to some degree, characterized education in all four of these veins.

Among his many and varied writings Dewey examines education as an art (Dewey, 1928 1929a) as a science (Dewey, 1928, 1929b), and as Engineering (Dewey, 1929c). In a discussion of the relationship of art. science, and engineering to education Dewey (1929b) writes:

> That, in concrete operation, education is an art, either a mechanical art or a fine art is unquestionable. If there were an opposition between science and art, I should be compelled to side with those who assert that education is an art. But there is no opposition, although there is a distinction. We must not be misled by words. Engineering is, in actual practice, an art. But it is an art that progressively incorporates more and more science into itself, more of mathematics, physics and chemistry. It is the kind of art it is precisely because of a content of scientific subject-matter which guides it as a practical

> operation. There is room for the original and daring projects of exceptional individuals. But their distinction lies not in the fact that they turn their back on science, but in the fact that they make new integrations of scientific material and turn it to new and previously unfamiliar and unforeseen uses. When, in education, the psychologist or observer and experimentalist in any field reduces his findings to a rule which is uniformly adopted, then, only, is there a result which is objectionable and destructive of the free play of education as an art.
>
> But this happens not because of scientific method but because of departure from it. It is not the capable engineer who treats scientific findings as imposing upon him a certain course which is to be rigidly adhered to: it is the third- or fourth-rate man who adopts this course. Even more, it is the unskilled day laborer who follows it. For even if the practice adopted is one that follows from science and could not have been discovered or employed except for science, when it is converted into a uniform rule of procedure it becomes an empirical rule-of-thumb procedure-just as a person may use a table of logarithms mechanically without knowing anything about mathematics (Dewey, 1929, p.635-636).

It must be acknowledged that in the early part of the twentieth century 'science' often held a meaning that is substantially different then the meaning that is ascribed to it today. However, because of the influence that Dewey has had on the field of education, later scholars adopted his language in new contexts. This adoption of language without accounting for changes in popular meaning has led to confusion within the field of education in general, and also in the field of educational technology.

Contemporaries of Dewey have also used the words art, science and engineering to discuss education and concepts that are related to it. William Heard Kilpatrick (1925) argues that education is an art. E. L. Thorndike (1913) promotes a view that education is a science. Franklin Bobbitt refers to "educational engineers" (1912).

Individuals writing after the era of progressive education had come to a close, continued discussing education and some of its related concepts as art, science, and engineering. Gilbert Highet (1958) referred to teaching as an art. W.W. Charters (1945) discusses educational engineering. B.F. Skinner (1954) argues for a science of learning.

The idea of craft is noticeably missing from the previous discussion. Perhaps this was due to the growing acceptance of "scientific-method" during the early portion of the twentieth century. Science, as a modern concept, would have been seen in opposition to craft which may have been taken as outmoded.

It is in the era of post-progressive education that the word craft gains popularity in the education literature (cf.Thom, Blumberg). This may be due to a backlash against scientific and engineering approaches to education. It may also be due to the acceptance of certain contributions of science to the field of education. The use of scientific knowledge in the field of education has become more refined. It has become clearer that science contributes to the development of educational procedures and not to the setting of educational goals (Kliebard,1986). One could infer from this that scientific based procedures alone are insufficient for completing the educational enterprise. As such, the idea of craft, because it can include these scientific procedures, gains in popularity.

The idea that, both, technology and education has been viewed as art, science, engineering, and craft has been with us for for a long time. Therefore, it seems appropriate that these four words or interpretations of technology and education: art, science craft, and engineering, will be the interpretations that are used to analyze educational technology in the remainder of this study.

Art, craft, science and engineering in educational technology

The words art, craft, science, and engineering are not new as descriptors of educational technology. Educational technology has been characterized as being an art by Hylenka (1991), Bass and Dills (1984), and Davies (1984). It has been called a craft by Finn (1953) and Driscoll (1990) and a science by Lumsdaine (1964) and Reigeluth (1983). It has also been called engineering by Bern (1961), Szabo (1968), and Heinich (1984).

The words art, craft, science and engineering are really quite familiar to the literature of educational technology. But an analysis of these familiar and obvious connotations shows that they are not easily distinguishable from one another. And seldom are the reasons for using these characterizations and their implications made explicit by their users in our field.

Science

The characterization of educational technology as a science is over thirty years old. In an article relating technology to education Finn (1960) chose not to distinguish between science and technology.

> For purposes of this paper, no distinction is made between "science" and "technology" or between "pure" and "applied" science (Finn,1960 p.84).

A discussion of the distinction between science and technology would certainly have been helpful to Finn's readers, but it was not central to the thesis of the paper. But by not making the distinction Finn contributes to the confusion and ambiguity of the concept.

Lumsdaine (1964) outlines the premises and importance of a science of instruction. There are three ideas that are central to the existence of a science of instruction: 1) the desire to generate rules which can be generalized beyond specific situations, 2) the generating and testing of hypotheses, 3) the use of experimental techniques. Lumsdaine writes:

> The attempt to develop instructional materials not only to serve as a vehicle for testing hypotheses but also to attain a high degree of instructional effectiveness tends to generate provisional "rules" for effective programming of instruction, which can be implemented in experimental materials even though these rules are not tested directly within the confines of a given programming project. Such working guidelines need to be translated into hypotheses that can be subjected to experimental test if a genuine science of instruction is to evolve (Lumsdaine, 1964 p.400).

He concludes:

> Finally, it may well be re-emphasized that the differences in present conceptions and forms of programming as well as their current theoretical rationales, are less important than the basic conviction that instruction is amenable to systematic description and improvement through experimental inquiry (Lumsdaine, 1964 p.401).

The science conception of educational technology holds that it is an area of study (instruction) which should be investigated by the use of methods and techniques (experimental) associated with the traditional sciences. The goal is to be able to prescribe interventions (actions) to bring about desired outcomes.

Engineering

The idea of problem solving is crucial to an engineering conception of educational technology. Discussing the method of the educational engineer, W. W. Charters (1945) writes:

> First, the educational engineer accepts an idea to develop, a problem to solve, or a question to answer....Having accepted an idea to work upon, his next step is a logical definition of the problem....He must know precisely what he is supposed to do. When a problem has been defined, the educational engineer analyzes it to discover the factors that must be considered. Each of the factors requires analysis that must be considered. Thereupon, the assignment is planned. His attention is engrossed in the methods to be used to control the factors. He concentrates upon the "how" of his project; he decides that he will define the objectives in this manner, make his selection of words in that fashion, and determine the related characteristics in another way. These specifications he formulates with the greatest of care because upon their excellence rests the success of his project.
>
> Having completed his plans, he proceeds to construct his project by carrying out the operations which have been specified in the manner decided upon. The labor of construction consumes the major portion of the time spent upon a project although their plan is the most critical step in program building. When the instrument has been constructed, operation follows. Planning and construction have been carried on to that end. The idea has been given body on the assumption that, when properly implemented, it will improve instruction. The problem has been solved with the expectation that its solution will increase the efficiency of school processes.
>
> The final phase of the engineering method in education is evaluation. When the operation is completed, it is tested to see if it fulfills its function adequately. If it does, it continues to be used. If it does not, it may be discarded. But if the idea is properly treated in the early stages of the engineering process, evaluation and testing result in further improvements in the program rather than its rejection (Charters,1945, p.36-37 & 56).

Heinich (1984) accepts the premise that educational technology is basically an engineering view. He argues that educational technology is an applied field which is concerned with means and ends.

> Instruction is the management of learning, and instructional management, like engineering, is a class of its own made up of a complex organization of men, machines, and processes (p.84).

But, Heinich also challenges the scientific conception of educational technology.

> A large-scale instructional problem may not be best analyzed in terms of individual personalogical variables or isolated media attributes but by a consideration of demographics of students, organizational relationships, the sociology of the instructional environment, delivery systems, etc. The laboratory approach of many of our researchers frequently is not compatible with instructional management realities.
>
> We need to remember that research techniques designed to establish cause-and-effect relationships may not be suitable for means-ends problems. Research designs and statistical techniques most appropriate for conclusion-oriented research may impose artificial and unrealistic constraints on decision-oriented (situation-specific) questions....The techniques of operations research in engineering and business administration are more "sympatico" with decision-oriented problems in instructional systems.
>
> We have emulated science in our research for too long. There are many reasons for this, a few implied earlier, but surely the higher status accorded science over technology in higher education and the virtual adoration of SCIENCE by the public are important factors (Heinich, 1984, p.84).

Critics of educational technology often treat the engineering and the science conceptions of educational technology as if they were the same. No doubt there are some similarities, and there are many cases where such a categorization scheme is justified. But certainly an engineering conception of educational technology differs substantially from a science conception. The science conception focuses on prescriptions derived from experimental methods, the engineering conception on problem solving and applications that include more considerations than the experimental method.

Art-then Craft

Davies (1991) dissects the concepts of craft and art as they relate to instructional development.

> Admitting the role of art, craft, and science in instructional development, however, is not the same as suggesting that ID, itself, is a craft or science. Indeed, instructional development is very definitely an art. There have been, however, many attempts to make it a craft, while arguing it is a science. It is ironic that when developers highlight the design, development, implementation and evaluation stages-in the belief that these somehow confer the status of scientific endeavor-they are, in fact, reinforcing the craft side of what is essentially a creative act of inquiry.
>
> Attempts to make instructional development a craft or a science have supplied in the first case a heuristic, and in the latter case a recipe or algorithm, that has largely failed to realize the potential of ID. To a certain extent, the problem arises from a misunderstanding of the nature of art, craft, and science. So has the equation of science with technology....
>
> Art and craft are often confused. They are usually seen as somewhat similar, the one shading the other. Science, on the other hand, is perceived as an entirely different process, probably because of its strong empirical

basis. The distinctions, however, in reality are much more subtle than they appear. It is easier to distinguish between art and craft (Davies,1991 p.96).

The distinctions between art and craft Collingwood (1938) argues in *Principles of Art* are best seen from the perspective of certain key characteristics. They include:

- Distinctions between means and ends.
- Distinctions between planning and implementation.
- Distinctions between raw material and finished product.
- Distinctions between form and matter.

In essence, if the distinctions are maintained in an activity, Collingwood argues that a craft is involved. If the distinctions are largely absent, blur, or coexist with the other, then an art is at work (Davies, 1991, pp.97-98).

Later Davies discusses the criteria for successful instructional development. They are phrased in the form of questions.

> Are the end results (sensitivities, values, attitudes, skills, knowledge) worthwhile?...
> Have the understandings, attitudes and skills essential to mastery been acquired?...
> Have the learnings been integrated into people's lives, so that reliable performance is achieved?...(Davies, 1991 p.102-103).

Davies argues, with a blend of passion and reason, that instructional development should be treated as an art. He differentiates the concepts of systematic and systemic. Systematic is associated with craft and systemic with art. The crux of the argument is that systematic infers separate stages in a process, that means and ends are separate. Systemic infers that there are not necessarily separate stages in instructional development, that they can co-exist.

There is some confusion in this overall argument. One the one hand Davies states: "Indeed, instructional development is very definitely an art (p.96)." This can be taken to mean that if one is 'doing' instructional development one must be engaged in art. However, the subsequent discussion and reasoning about the systematic-systemic difference leaves the impression that instructional development can be either an art or a craft.

An implication

What does this mean for the field of educational technology? Here, the discussion will be limited to implications for professionalism. Finn (1953) argues that

> ...a profession has, at least, these characteristics: (a) an intellectual technique, (b) an application of that technique to the practical affairs of man, (c) a period of long training necessary before entering into the profession, (d) an association of the members of the profession into a closely-knit group with a high quality of communication between members, (e) a series of standards and a statement of ethics which is enforced, and (f) an organized body of intellectual theory constantly expanding by research (Finn,1953 p.7).

Finn then explains the importance of the sixth criteria:

> ...the most fundamental and most important characteristic of a profession is that the skills involved are founded upon a body of intellectual theory and research. Furthermore, this systematic theory is constantly being expanded by research and thinking within the profession. As Whitehead says, "...the practice of a profession cannot be disjoined from its theoretical understanding or vice versa...The antithesis to a profession is an avocation based upon customary activities and modified by the trial and error of practice. Such an avocation is a Craft...." (16:557) The difference between a bricklayer and the architect lies right here (Finn,1953 p.8).

Finn's intent was to move the audio-visual field from a status of lowly craft to that of a profession. The field of educational technology has long labored under Finn's influence in regards to professionalism. The Association for Educational Communications and Technology (AECT, 1977) has reiterated these conditions for being a profession.

But does this explanation hold up in its entirety? Another way to view "the trial and error of practice" is to call it evaluation. Evaluation, or some like term (criteria check, testing), is a concept that is key to all of the conceptions of educational technology that have been discussed. If this is the lone criteria for craft status, then educational technology is a craft. Educational technologists should be pleased to be thought of as doing a craft, but many are not. Likely this is due to historical considerations. As stated above, craft was seen as something below science, art, and engineering.

One possible way around this difficulty is to consider Pratte and Rury's (1991) discussion of professionalism. They argue that "professionalism...is an ideal to which individuals and occupational groups aspire, in order to distinguish themselves from other workers (p.60)." Pratte and Rury focus on teaching, they call it a craft-profession. They claim

> ...a craft-profession does not rest on a highly formal or codified body of knowledge. Instead, competence for craft-professionals is defined in terms of various skills and practices, reflecting a different sort of knowledge base...much of their knowledge is embodied, something that they learn by doing and that is experientially learned, rather than acquired in a systematic, highly formal fashion (p.62).
>
> To a large extent the distinction between the conceptual (formal) knowledge characteristic of the expert professions and the embodied (experiential) knowledge of the crafts is too finely drawn, perhaps even artificial, as all occupations require both formal and experiential knowledge. It appears that the fundamental point is one of identifying the extent to which a given occupation is dominated by one or the other (p.63).
>
> the concept of craft seems to belong to both the world of skill and the world of calling or profession. The ordinary language appeal of the term is to some shared understanding of what a craft is, to a union of technique and theory. One can, we suppose, be too scrupulous about the matter, but the concept of craft should be understood as an art or skill in a field or calling having appropriate standards-in short, action willingly engaged in accord with publicly agreed on criteria (p.63).

Certainly language can be 'overly scruitinized'. But it seems that discussions of educational technology as Art, Craft, Science and Engineering do shed light on how users of these terms view educational technology as a field of study and as a profession. It seems that sometimes the use of these terms is conscious and sometimes it is not. Sometimes it is an attempt to gain prestige, sometimes it is an attempt to avoid using a word, and sometimes it is simply an attempt to communicate an idea.

Conclusion

It appears as if there are different ways in which educational technology can be characterized. At first glance, one might think that all design is science, development is craft, and all management functions are engineering. But, the reality is that this view is simplistic. It is much more complicated than that. What the analysis in this paper seems to show is that the four characterizations of the term 'educational technology' do currently exist in our field and they have been present for some time.

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